



# LK315T3LZ41C

## TFT-LCD Module

Spec. Issue Date: June 30, 2007

No: LD-15606C





## 1. Application

This specification applies to the color 31.5" Wide XGA TFT-LCD module LK315T3LZ41C.

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## 2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, inverter circuit and back light system etc. Graphics and texts can be displayed on a 1366×RGB×768 dots panel with 16,777,216 colors by using LVDS (Low Voltage Differential Signaling) to interface, +5V of DC supply voltages.

This module also includes the DC/AC inverter to drive the CCFT. (+24V of DC supply voltage)

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

By using the captioned process, the image signals of this LCD module are being set so that image response can be completed within one frame, as a result, image blur can be improved and clear image performance can be realized.

## 3. Mechanical Specifications

| Parameter                    | Specifications                                                            | Unit  |
|------------------------------|---------------------------------------------------------------------------|-------|
| Display size                 | 80.04 (Diagonal)                                                          | cm    |
|                              | 31.5 (Diagonal)                                                           | inch  |
| Active area                  | 697.69 (H) x 392.26 (V)                                                   | mm    |
| Pixel Format                 | 1366 (H) x 768 (V)<br>(1pixel = R + G + B dot)                            | pixel |
| Pixel pitch                  | 0.51075(H) x 0.51075 (V)                                                  | mm    |
| Pixel configuration          | R, G, B vertical stripe                                                   |       |
| Display mode                 | Normally black                                                            |       |
| Unit Outline Dimensions (*1) | 780.0(W) x 450.0(H) x 51.0(D)                                             | mm    |
| Mass                         | 6.4±0.3                                                                   | kg    |
| Surface treatment            | Anti glare, low reflection coating<br>Hard coating: 2H<br>Haze: 23 +/- 5% |       |

(\*1) Outline dimensions are shown in Fig.1



#### 4. Input Terminals

##### 4-1. TFT panel driving

CN1 (Interface signals and +5V DC power supply) (Shown in Fig.1)

Using connector : FI-X30SSL-HF (Japan Aviation Electronics Ind. , Ltd.) or equivalent

Mating connector : FI-X30H, FI-X30C or FI-X30M (Japan Aviation Electronics Ind. , Ltd.)

Mating LVDS transmitter : THC63LVDM83A or equivalent device

| Pin No. | Symbol   | Function                                  | Remark                     |
|---------|----------|-------------------------------------------|----------------------------|
| 1       | VCC      | +5V Power Supply                          |                            |
| 2       | VCC      | +5V Power Supply                          |                            |
| 3       | VCC      | +5V Power Supply                          |                            |
| 4       | VCC      | +5V Power Supply                          |                            |
| 5       | GND      | GND                                       |                            |
| 6       | GND      | GND                                       |                            |
| 7       | GND      | GND                                       |                            |
| 8       | GND      | GND                                       |                            |
| 9       | SELLVDS  | Select LVDS data order 【Note 1】           | Pull up<br>Default H:3.3V  |
| 10      | NC       |                                           |                            |
| 11      | GND      | Ground                                    |                            |
| 12      | RIN0-    | Negative (-) LVDS differential data input | LVDS                       |
| 13      | RIN0+    | Positive (+) LVDS differential data input | LVDS                       |
| 14      | GND      | Ground                                    |                            |
| 15      | RIN1-    | Negative (-) LVDS differential data input | LVDS                       |
| 16      | RIN1+    | Positive (+) LVDS differential data input | LVDS                       |
| 17      | GND      | Ground                                    |                            |
| 18      | RIN2-    | Negative (-) LVDS differential data input | LVDS                       |
| 19      | RIN2+    | Positive (+) LVDS differential data input | LVDS                       |
| 20      | GND      | Ground                                    |                            |
| 21      | CLKIN-   | Clock Signal(-)                           | LVDS                       |
| 22      | CLKIN+   | Clock Signal(+)                           | LVDS                       |
| 23      | GND      | Ground                                    |                            |
| 24      | RIN3-    | Negative (-) LVDS differential data input | LVDS                       |
| 25      | RIN3+    | Positive (+) LVDS differential data input | LVDS                       |
| 26      | GND      | Ground                                    |                            |
| 27      | R/L      | Horizontal shift direction 【Note 2】       | Pull down<br>Default L:GND |
| 28      | U/D      | Vertical shift direction 【Note 2】         | Pull down<br>Default L:GND |
| 29      | Reserved | Not Available                             |                            |
| 30      | Reserved | Not Available                             |                            |

【note】 GND of a liquid crystal panel drive part has connected with a module chassis.



## 【Note1】SELLVDS

| Transmitter |      | SELLVDS |                  |
|-------------|------|---------|------------------|
| Pin No      | Data | =L(GND) | =H(3.3V) or Open |
| 51          | TA0  | R0(LSB) | R2               |
| 52          | TA1  | R1      | R3               |
| 54          | TA2  | R2      | R4               |
| 55          | TA3  | R3      | R5               |
| 56          | TA4  | R4      | R6               |
| 3           | TA5  | R5      | R7(MSB)          |
| 4           | TA6  | G0(LSB) | G2               |
| 6           | TB0  | G1      | G3               |
| 7           | TB1  | G2      | G4               |
| 11          | TB2  | G3      | G5               |
| 12          | TB3  | G4      | G6               |
| 14          | TB4  | G5      | G7(MSB)          |
| 15          | TB5  | B0(LSB) | B2               |
| 19          | TB6  | B1      | B3               |
| 20          | TC0  | B2      | B4               |
| 22          | TC1  | B3      | B5               |
| 23          | TC2  | B4      | B6               |
| 24          | TC3  | B5      | B7(MSB)          |
| 27          | TC4  | NA      | NA               |
| 28          | TC5  | NA      | NA               |
| 30          | TC6  | DE(*)   | DE(*)            |
| 50          | TD0  | R6      | R0(LSB)          |
| 2           | TD1  | R7(MSB) | R1               |
| 8           | TD2  | G6      | G0(LSB)          |
| 10          | TD3  | G7(MSB) | G1               |
| 16          | TD4  | B6      | B0(LSB)          |
| 18          | TD5  | B7(MSB) | B1               |
| 25          | TD6  | NA      | NA               |

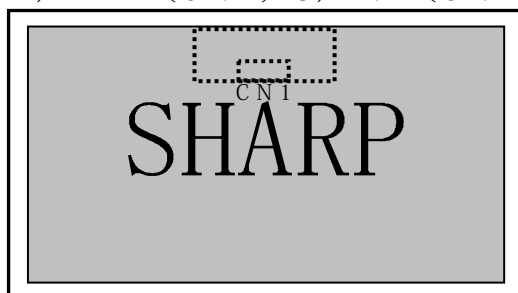
NA: Not Available

(\*) Since the display position is prescribed by the rise of DE (Display Enable) signal, please do not fix DE signal during operation at "High."

## 【Note 2】 Display reversal function

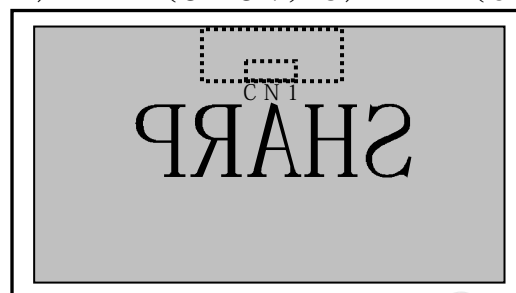
Normal (Default)

R/L : L (GND) U/D:L (GND)



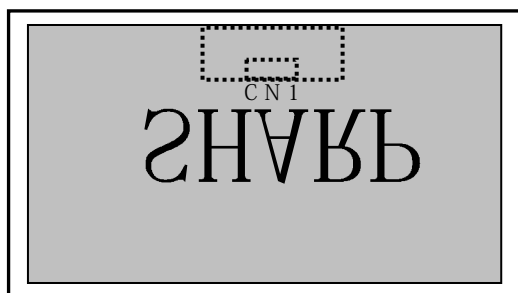
Horizontal reverse image

R/L : H (3.3V) U/D:L (GND)



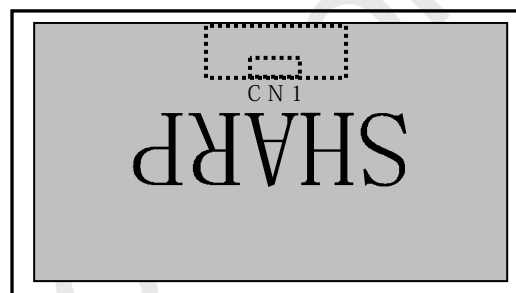
Vertical reverse image

R/L : L (GND) U/D:H (3.3V)



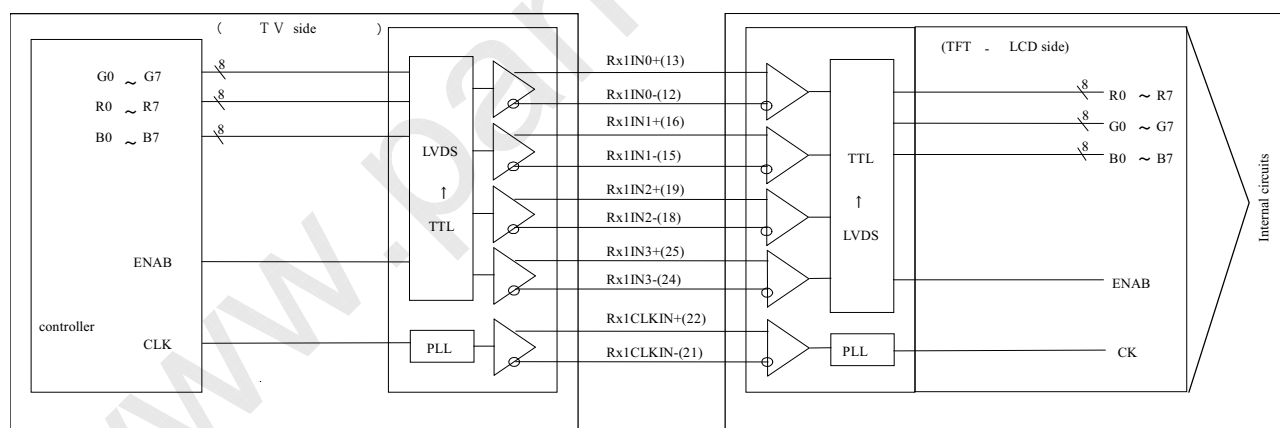
Horizontal and vertical reverse image

R/L : H (3.3V) U/D:H (3.3V)



## • Interface block diagram

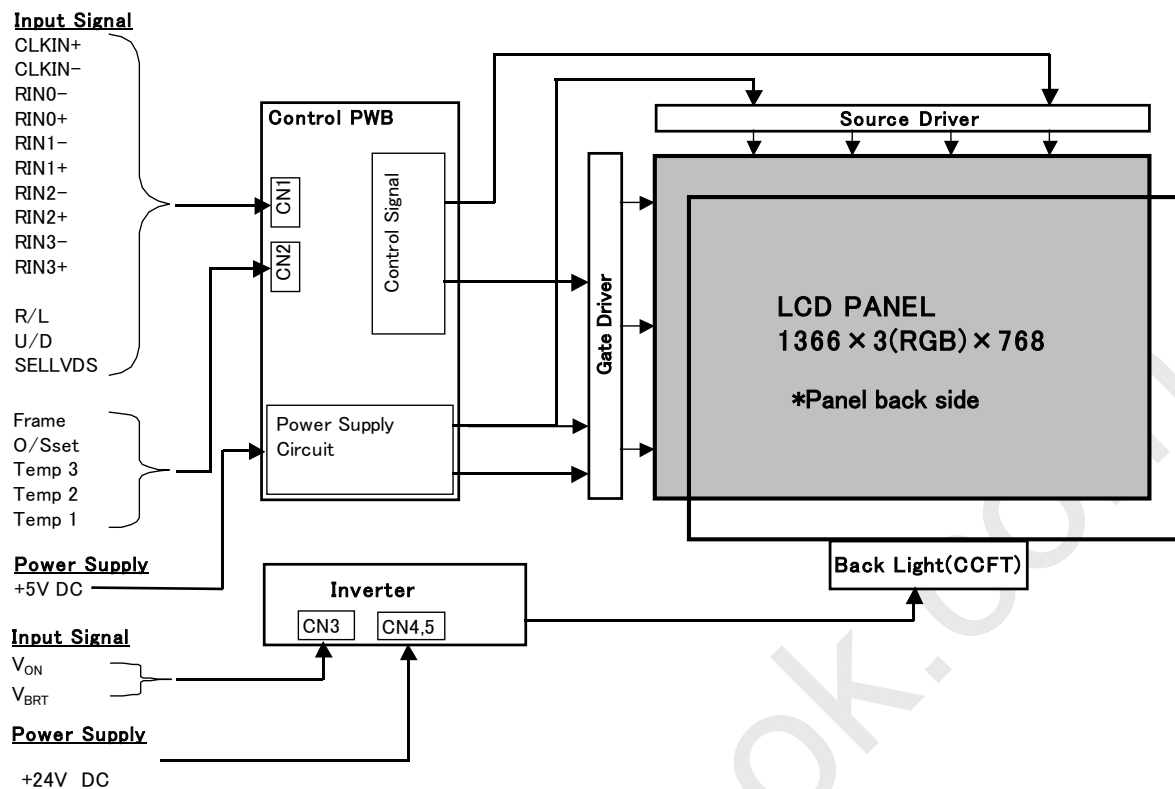
Corresponding Transmitter: THC63LVDM83R (THine) or equivalent device

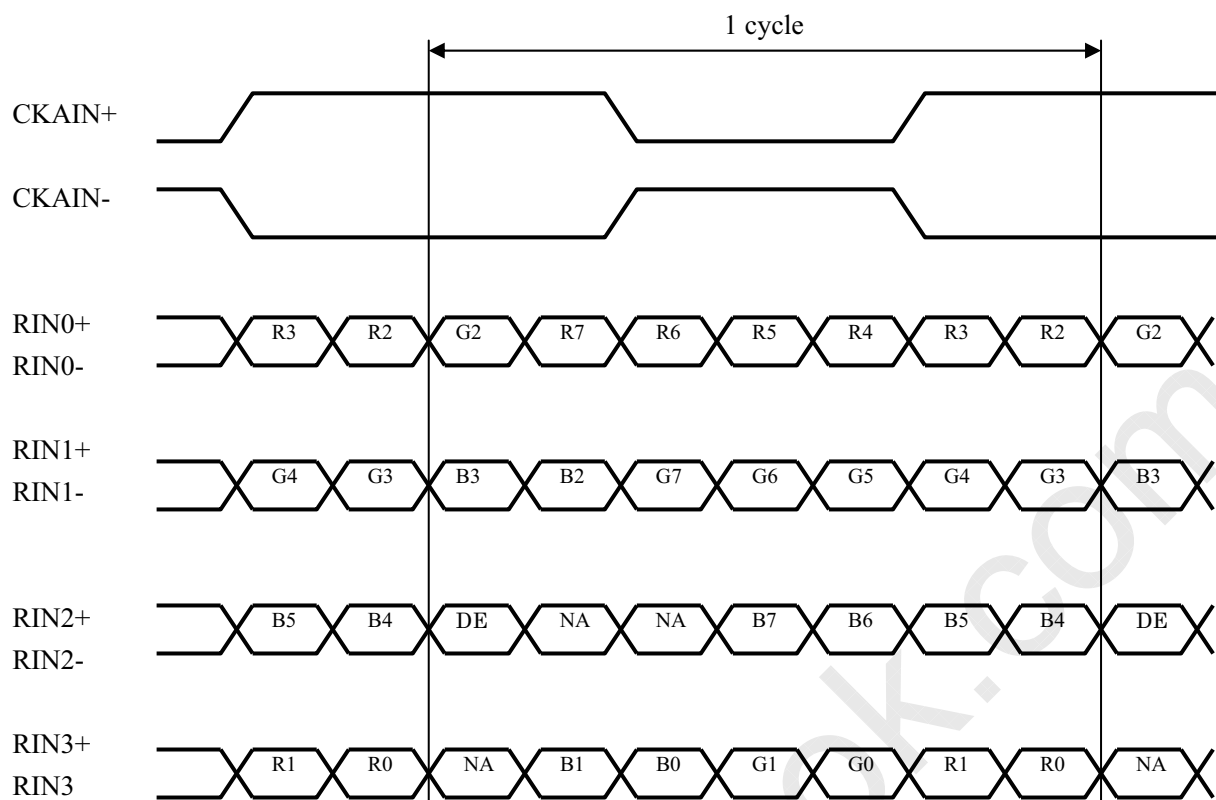
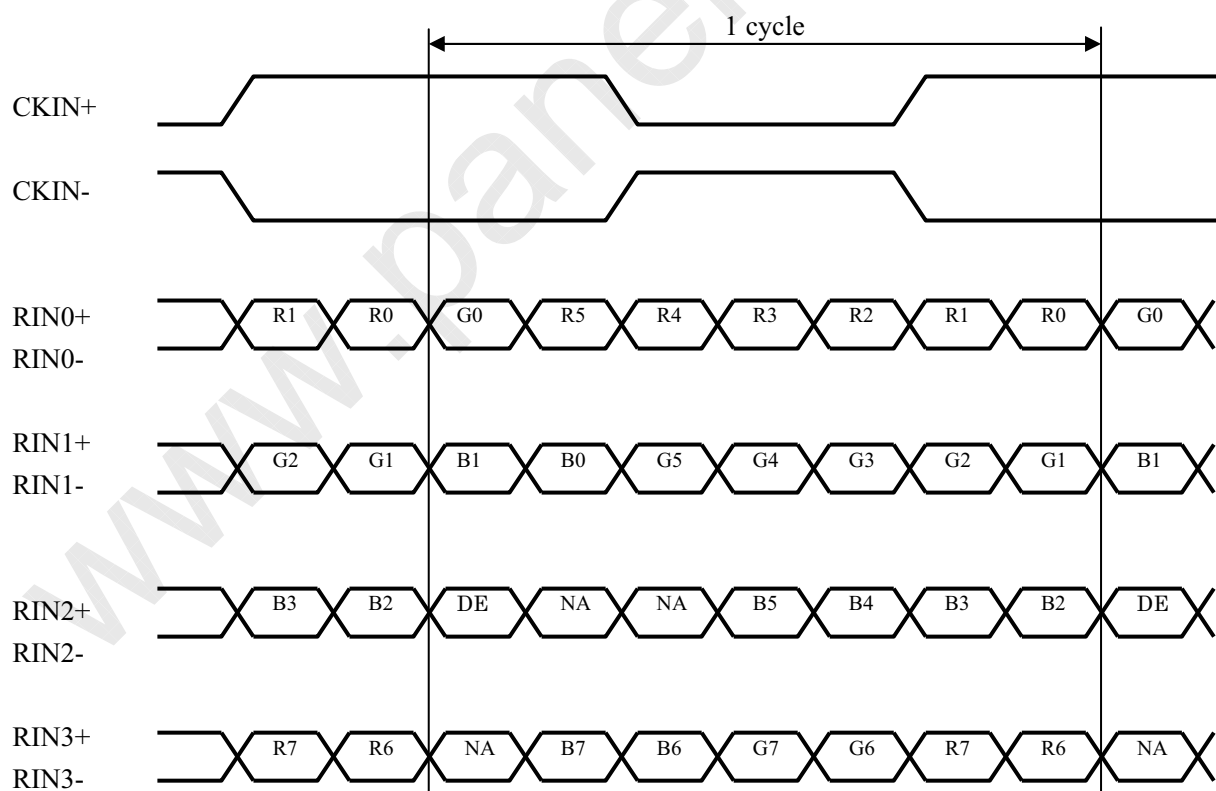




LD- 17416-5

## • Block Diagram (LCD Module)



**SELLVDS= High (3.3V) or Open****SELLVDS= Low(GND)**

DE: Display Enable

NA: Not Available (Fixed Low)





## 4.3. Backlight driving

CN4 (+24V DC power supply and inverter control)

Using connector: S14B-PH-K-S (LF) (JST)

Mating connector: PHR-14 (JST)

| Pin No. | Symbol            | Function                                      | Default(OPEN)                         | Input Impedance | Remark   |
|---------|-------------------|-----------------------------------------------|---------------------------------------|-----------------|----------|
| 1       | V <sub>INV</sub>  | +24V                                          | -                                     |                 |          |
| 2       | V <sub>INV</sub>  | +24V                                          | -                                     |                 |          |
| 3       | V <sub>INV</sub>  | +24V                                          | -                                     |                 |          |
| 4       | V <sub>INV</sub>  | +24V                                          | -                                     |                 |          |
| 5       | V <sub>INV</sub>  | +24V                                          | -                                     |                 |          |
| 6       | GND               |                                               | -                                     |                 |          |
| 7       | GND               |                                               | -                                     |                 |          |
| 8       | GND               |                                               | -                                     |                 |          |
| 9       | GND               |                                               | -                                     |                 |          |
| 10      | GND               |                                               | -                                     |                 |          |
| 11      | Reserved          | For LCD module internal usage, should be open |                                       |                 |          |
| 12      | V <sub>ON</sub>   | Inverter ON/OFF                               | GND : pull down<br>Inverter OFF       | 22K ohm         | [Note 1] |
| 13      | V <sub>BRT</sub>  | Brightness Control                            | 3.3V : pull up<br>Brightness 100%     | 100K ohm        | [Note 3] |
| 14      | V <sub>BRT_</sub> | sel Brightness Control selection              | 3.3V : pull up<br>Selected Analog PWM | 100K ohm        | [Note 2] |

\*GND of an inverter board is not connected to GND of a module chassis and a liquid crystal panel drive part.

[Note 1] Inverter ON/OFF

| Input voltage | Function       |
|---------------|----------------|
| 0V            | Inverter : OFF |
| 3.3V          | Inverter : ON  |



#### 4-3. The back light system characteristics

The back light system is direct type with 18 CCFTs (Cold Cathode Fluorescent Tube).

The characteristics of the lamp are shown in the following table.

The value mentioned below is at the case of one CCFT.

| Item      | Symbol         | Min.  | Typ. | Max. | Unit | Remarks |
|-----------|----------------|-------|------|------|------|---------|
| Life time | T <sub>L</sub> | 60000 | -    | -    | Hour | 【Note】  |

【Note】 • Lamp life time is defined as the time when brightness becomes 50% of the original value in the continuous operation under the condition of Ta=25 °C and brightness control(V<sub>BRT</sub>=0V).

- This definition is valid with the condition that the module is placed horizontally. (The wide side of the module should be parallel to the ground.)

**5. Absolute Maximum Ratings**

| Parameter                            | Symbol                              | Condition | Ratings    | Unit | Remark   |
|--------------------------------------|-------------------------------------|-----------|------------|------|----------|
| Input voltage<br>(for Control)       | V <sub>I</sub>                      | Ta=25 °C  | -0.3 ~ 3.6 | V    | 【Note 1】 |
| 5V supply voltage<br>(for Control)   | VCC                                 | Ta=25 °C  | 0 ~ + 6    | V    |          |
| Input voltage<br>(for Inverter)      | V <sub>BRT</sub><br>V <sub>ON</sub> | Ta=25 °C  | 0 ~ + 6    | V    |          |
| 24V supply voltage<br>(for Inverter) | V <sub>INV</sub>                    | Ta=25 °C  | 0 ~ +29    | V    |          |
| Storage temperature                  | Tstg                                | -         | -25 ~ +60  | °C   | 【Note 2】 |
| Operation temperature<br>(Ambient)   | Topa                                | -         | 0 ~ +50    | °C   |          |

【Note 1】 SELLVDS, R/L, U/D,TEST, Frame, O/S set, Temp1, Temp2, Temp3

【Note 2】 Humidity 95%RH Max.(Ta≤40℃)

Maximum wet-bulb temperature at 39 °C or less.(Ta>40 °C)

No condensation.

## 6. Electrical Characteristics

### 6-1. Control circuit driving

Ta=25 °C

| Parameter                            |                     | Symbol           | Min. | Typ. | Max. | Unit              | Remark                              |
|--------------------------------------|---------------------|------------------|------|------|------|-------------------|-------------------------------------|
| +5V supply voltage                   | Supply voltage      | V <sub>CC</sub>  | +4.5 | +5.0 | +5.5 | V                 | 【Note 1】                            |
|                                      | Current dissipation | I <sub>CC</sub>  | -    | 800  | 1800 | mA                | 【Note 2】                            |
| Permissible input ripple voltage     |                     | V <sub>RP</sub>  | -    | -    | 100  | mV <sub>P-P</sub> | V <sub>CC</sub> = +5.0V             |
| Differential input threshold voltage | High                | V <sub>TH</sub>  | -    | -    | 100  | mV                | V <sub>CM</sub> = +1.2V<br>【Note 6】 |
|                                      | Low                 | V <sub>TL</sub>  | -100 | -    | -    | mV                |                                     |
| Input Low voltage                    |                     | V <sub>IL</sub>  | -    | -    | 0.7  | V                 | 【Note 3】                            |
| Input High voltage                   |                     | V <sub>IH</sub>  | 2.6  | -    | 3.3  | V                 |                                     |
| Input leak current (Low)             | I <sub>IL1</sub>    | I <sub>IL1</sub> | -    | -    | 100  | μA                | V <sub>I</sub> = 0V<br>【Note 4】     |
|                                      | I <sub>IL2</sub>    | I <sub>IL2</sub> | -    | -    | 400  | μA                | V <sub>I</sub> = 0V<br>【Note 5】     |
| Input leak current (High)            | I <sub>IH1</sub>    | I <sub>IH1</sub> | -    | -    | 100  | μA                | V <sub>I</sub> = 3.3V<br>【Note 4】   |
|                                      | I <sub>IH2</sub>    | I <sub>IH2</sub> | -    | -    | 400  | μA                | V <sub>I</sub> = 3.3V<br>【Note 5】   |
| Terminal resistor                    |                     | R <sub>T</sub>   | -    | 100  | -    | Ω                 | Differential input                  |

【Note】 V<sub>CM</sub>: Common mode voltage of LVDS driver.

【Note 1】

Input voltage sequences

$$0 < t_1 \leq 10\text{ms}$$

$$10\text{ms} \leq t_{2-1} \leq 20\text{ms}$$

$$t_{2-2} \geq 10\text{ms}$$

$$0 < t_3 \leq 1\text{s}$$

$$t_4 \geq 1\text{s}$$

$$t_5 \geq 200\text{ms}$$

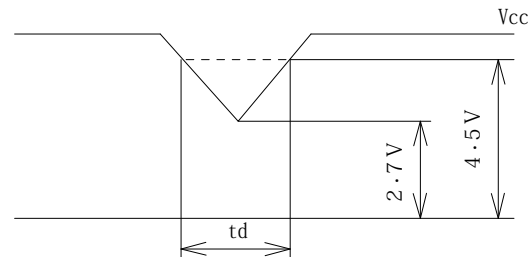
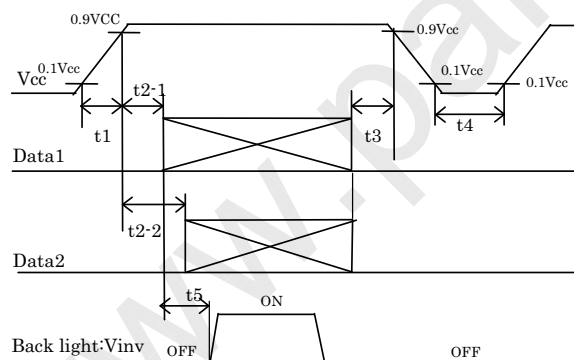
Dip conditions for supply voltage

$$\text{a) } 2.7\text{V} \leq V_{CC} < 4.5\text{V}$$

$$t_d \leq 10\text{ms}$$

$$\text{b) } V_{CC} < 2.7\text{V}$$

Dip conditions for supply voltage is based on input voltage sequence.



※ Data1:CLKIN±,RIN0±,RIN1±, RIN2±, RIN3±

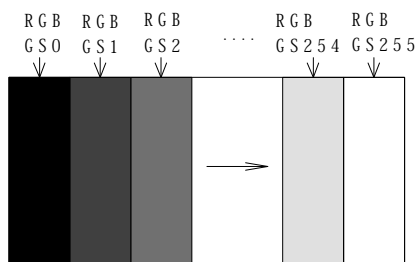
※ Data2:R/L,U/D,SELLVDS,Frame,O/Sset,Temp1,2,3

※ About the relation between data input and back light lighting, please base on the above-mentioned input sequence.

When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

【Note 2】 Typical current situation: 256 gray-bar pattern ( $V_{CC} = +5.0V$ )

The explanation of RGB gray scale is seen in section 8.



$V_{CC} = 5.0V$

$CK = 82.0MHz$

$Th = 20.67 \mu s$

【Note 3】 R/L, U/D, SELLVDS, TEST, Frame, O/S set, Temp1, Temp2, Temp3

【Note 4】 R/L, U/D

【Note 5】 SELLVDS, TEST, Frame, O/S set, Temp1, Temp2, Temp3

【Note 6】  $CKIN+/CKIN-$ ,  $RIN0+/RIN0-$ ,  $RIN1+/RIN1-$ ,  $RIN2+/RIN2-$ ,  $RIN3+/RIN3-$ ,

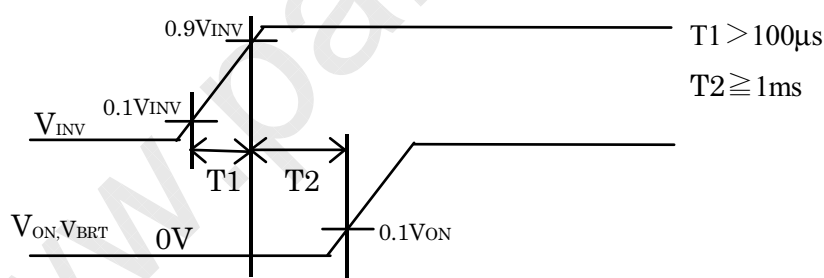
## 6-2. Inverter driving for back light

The back light system is direct type with 18 CCFTs (Cold Cathode Fluorescent Tube).

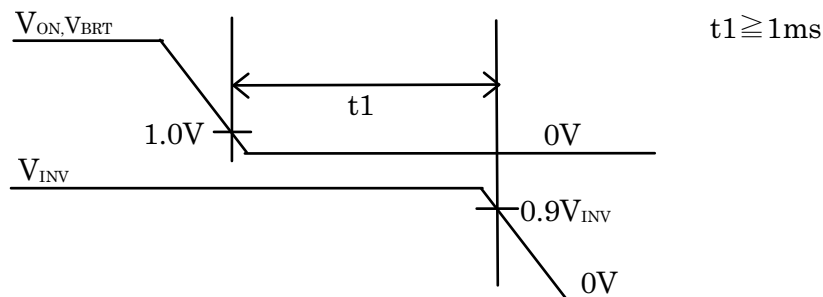
$T_a = 25^\circ C$

| Parameter                        | Symbol              | Min.      | Typ.          | Max. | Unit              | Remark                                                        |
|----------------------------------|---------------------|-----------|---------------|------|-------------------|---------------------------------------------------------------|
| +24V                             | Current dissipation | $I_{INV}$ | -             | 4.2  | A                 | $V_{INV} = 24V$<br>$V_{BRT} = 0V$ , $V_{ON} = 5V$<br>【Note 1】 |
|                                  | Supply voltage      | $V_{INV}$ | 22.5          | 24.0 | V                 |                                                               |
| Permissible input ripple voltage | $V_{RF}$            | -         | -             | 200  | mV <sub>p-p</sub> | $V_{INV} = +24V$                                              |
| Input voltage (Low)              | $V_{ONL}$           | 0         | -             | 1.0  | V                 | $V_{on}$<br>impedance=24k $\Omega$                            |
| Input voltage (High)             | $V_{ONH}$           | 3.0       | 5.0           | 6.0  | V                 |                                                               |
| Brightness control voltage       | $V_{BRT}$           | 0         | $\rightarrow$ | 5.0  | V                 | $V_{BRT}$<br>impedance=100k $\Omega$                          |

【Note 1】 1)  $V_{INV}$ -turn-on condition



2)  $V_{INV}$ -turn-off condition



## 7. Timing characteristics of input signals

### 7-1. Timing characteristics ▲A

Timing diagrams of input signal are shown in Fig.2

| Parameter          | Symbol                   | Min. | Typ.  | Max.  | Unit | Remark |
|--------------------|--------------------------|------|-------|-------|------|--------|
| Clock              | Frequency                | 1/Tc | 65    | 82    | 85   | MHz    |
| Data enable signal | Horizontal period        | TH   | 1560  | 1696  | 1940 | clock  |
|                    |                          |      | 20.20 | 20.67 | -    | μs     |
|                    | Horizontal period (High) | THd  | 1366  | 1366  | 1366 | clock  |
|                    | Vertical period          | TV   | 778   | 806   | 972  | line   |
|                    | Vertical period (High)   | TVd  | 768   | 768   | 768  | line   |

【Note】 When vertical period is very long, flicker and etc. may occur.

Please turn off the module after it shows the black screen.

Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.

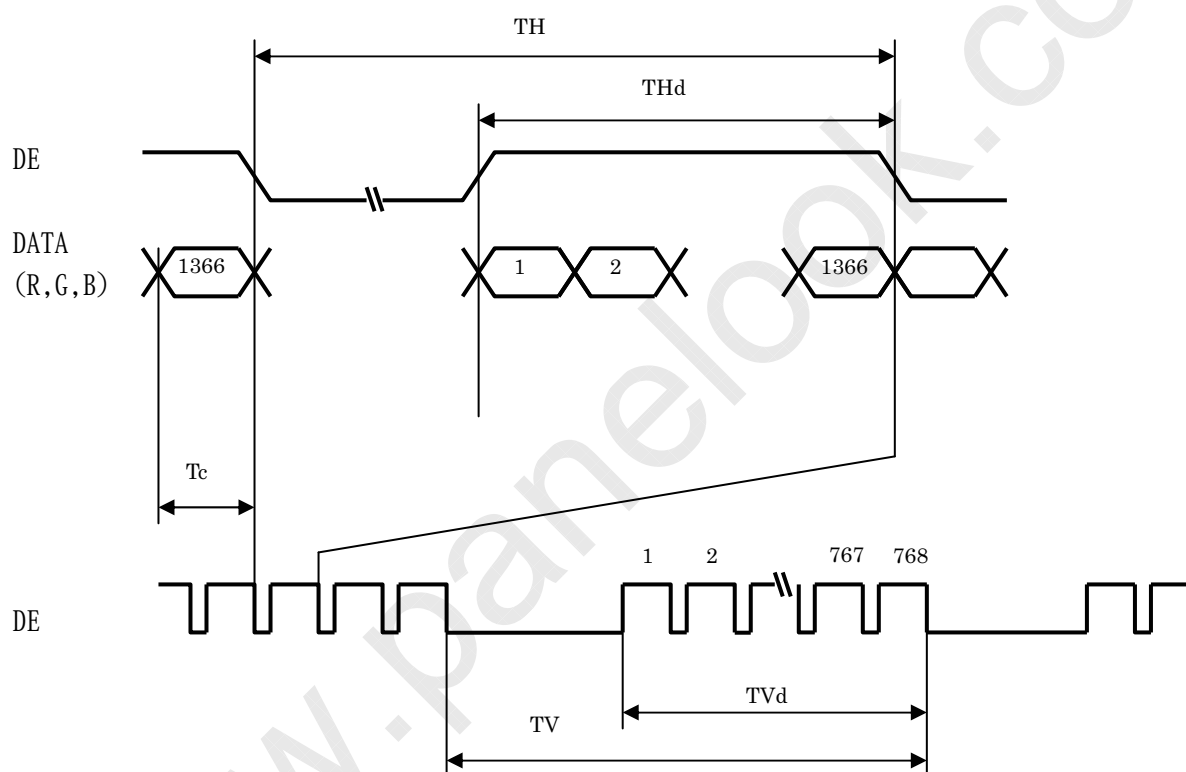
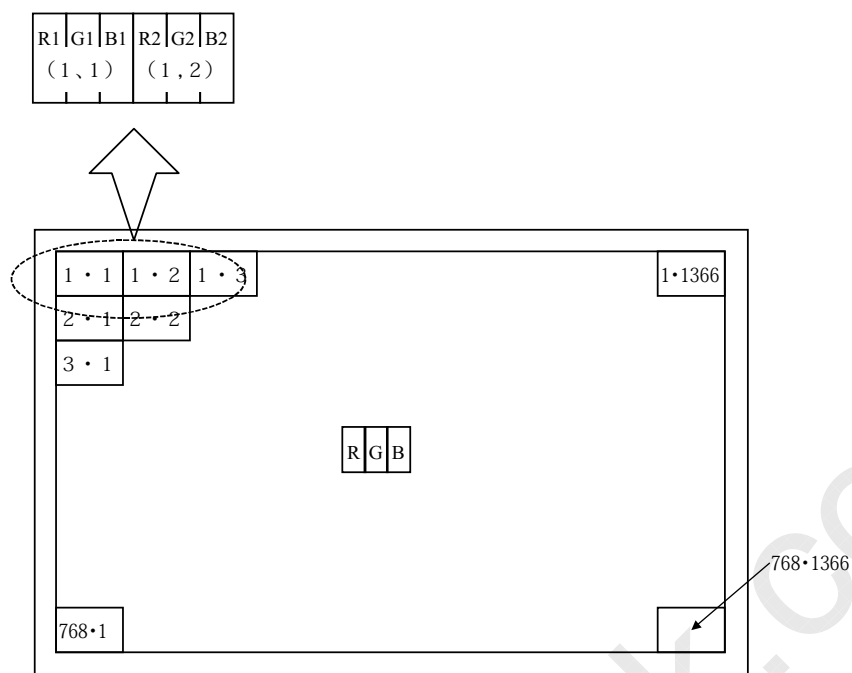


Fig.2 Timing characteristics of input signals



## 7-2. Input data signal and display position on the screen



Display Position of Data (V,H)



## 8. Input Signal, Basic Display Colors and Gray Scale of Each Color

|                     | Colors &<br>Gray scale | Data signal   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |
|---------------------|------------------------|---------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|
|                     |                        | Gray<br>Scale | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |  |  |  |
|                     |                        |               |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |
| Basic Color         | Black                  | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Blue                   | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Green                  | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Cyan                   | —             | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Red                    | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Magenta                | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Yellow                 | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | White                  | —             | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
| Gray Scale of Red   | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | GS1           | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Darker                 | GS2           | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |    |    |  |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |    |    |  |  |  |
|                     | Brighter               | GS253         | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↓                      | GS254         | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Red                    | GS255         | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
| Gray Scale of Green | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | GS1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Darker                 | GS2           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |    |    |  |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |    |    |  |  |  |
|                     | Brighter               | GS253         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↓                      | GS254         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Green                  | GS255         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
| Gray Scale of Blue  | Black                  | GS0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | GS1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | Darker                 | GS2           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |  |  |  |
|                     | ↑                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |    |    |  |  |  |
|                     | ↓                      | ↓             | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    | ↓  |    |    |    |    |    |    |    |    |    |  |  |  |
|                     | Brighter               | GS253         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | ↓                      | GS254         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |
|                     | Blue                   | GS255         | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |  |  |

0 : Low level voltage, 1 : High level voltage.

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16-million-color display can be achieved on the screen.



## 9. Optical characteristics

Ta=25°C, Vcc = +5V, VINV = +24V

| Parameter            |            | Symbol                         | Condition         | Min.  | Typ.  | Max.  | Unit              | Remark                        |
|----------------------|------------|--------------------------------|-------------------|-------|-------|-------|-------------------|-------------------------------|
| Viewing angle range  | Horizontal | $\theta_{21}$<br>$\theta_{22}$ | $CR \geq 10$      | 70    | 85    | -     | Deg.              | 【Note1,4】                     |
|                      | Vertical   | $\theta_{11}$<br>$\theta_{12}$ |                   | 70    | 85    | -     | Deg.              |                               |
| Contrast ratio       |            | CRn                            | $\theta = 0$ deg. | 600   | 800   | -     |                   | 【Note2,4】                     |
| Response time (1)    |            | $\tau_{d1}$                    | $\theta = 0$ deg. | -     | 6     | -     | ms                | 【Note3-1,4,5】<br>$V_{BRT}=0V$ |
|                      |            | $\tau_{r1}$                    |                   | -     | 6     | -     |                   |                               |
| Response time (2)    |            | $\tau_{r2}$                    | $\theta = 0$ deg. | -     | 12    | 20    | ms                | 【Note3-2,4,5】<br>$V_{BRT}=0V$ |
|                      |            | $\tau_{d2}$                    |                   | -     | 12    | 20    |                   |                               |
| Luminance of white   |            | X                              |                   | 0.242 | 0.272 | 0.302 | -                 | 【Note 4】                      |
|                      |            | Y                              |                   | 0.247 | 0.277 | 0.307 | -                 |                               |
| Luminance of red     |            | X                              |                   | 0.610 | 0.640 | 0.670 | -                 |                               |
|                      |            | Y                              |                   | 0.300 | 0.330 | 0.360 | -                 |                               |
| Luminance of green   |            | X                              |                   | 0.250 | 0.280 | 0.310 | -                 |                               |
|                      |            | Y                              |                   | 0.570 | 0.600 | 0.630 | -                 |                               |
| Luminance of blue    |            | X                              |                   | 0.120 | 0.150 | 0.180 | -                 |                               |
|                      |            | Y                              |                   | 0.030 | 0.060 | 0.090 | -                 |                               |
| Luminance of white   |            | $Y_{L1}$                       |                   | 400   | 500   |       | cd/m <sup>2</sup> | 【Note 4】                      |
| Luminance uniformity |            | $\delta_w$                     |                   | -     | -     | 1.25  |                   | 【Note 6】                      |

Measurement condition : Set the value of V<sub>BRT</sub> to maximum luminance of white.

\*The measurement shall be executed 60 minutes after lighting at rating.

【Note】 The optical characteristics are measured using the following equipment.

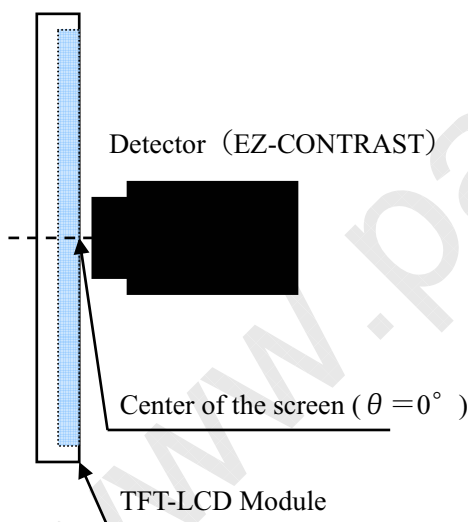


Fig.3-1 Measurement of viewing angle range.

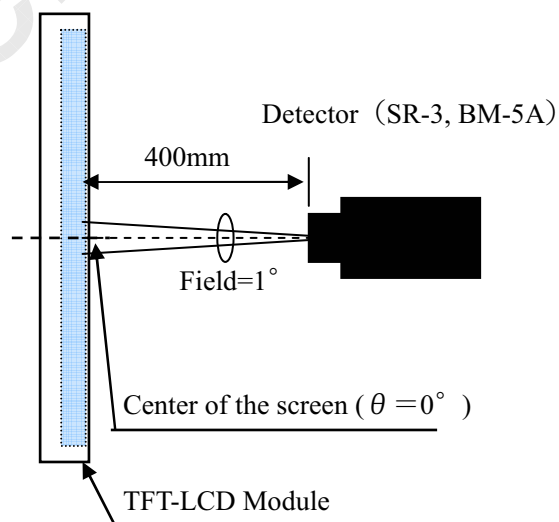
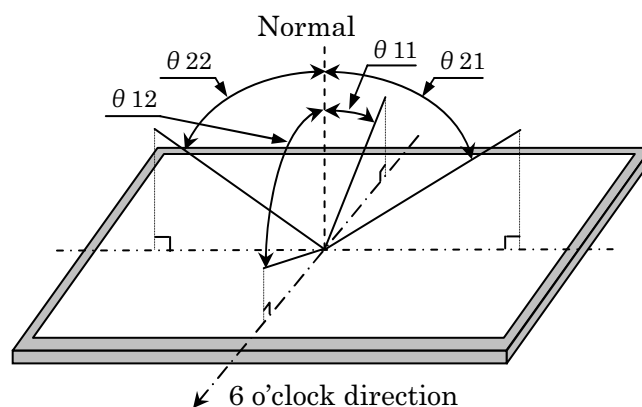


Fig.3-2 Measurement of Contrast, Luminance, Chromaticity and Response time.  
(Contrast, Luminance and Chromaticity: SR-3, Response time: BM-5A).

【Note 1】 Definitions of viewing angle range :



【Note 2】 Definition of contrast ratio :

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

【Note 3】 Definition of response time

### 3-1. Response time (1)

The response time ( $\tau_{d1}$  and  $\tau_{r1}$ ) is defined as the following figure and shall be measured by switching the input signal for “any level of gray (GS0, GS32, GS64, GS96, GS128, GS160, GS192, GS224 and GS255)” and “any level of gray (GS0, GS32, GS64, GS96, GS128, GS160, GS192, GS224 and GS255)”.

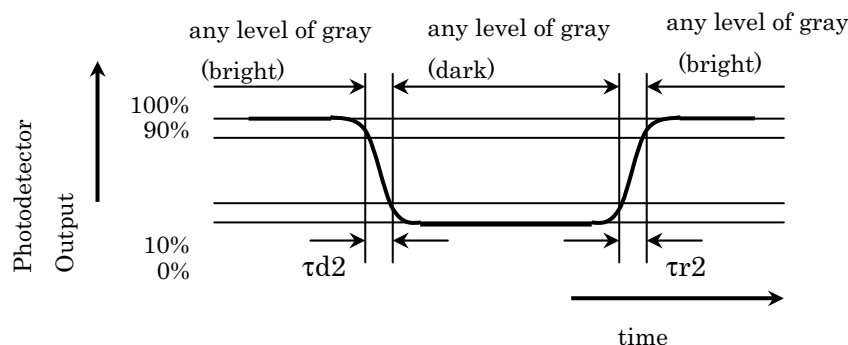
|       | GS0      | GS32      | GS64      | GS96      | GS128      | GS160      | GS192      | GS224      | GS255      |
|-------|----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|
| GS0   |          | tr:0-32   | tr:0-64   | tr:0-96   | tr:0-128   | tr:0-160   | tr:0-192   | tr:0-224   | tr:0-255   |
| GS32  | td:32-0  |           | tr:32-64  | tr:32-96  | tr:32-128  | tr:32-160  | tr:32-192  | tr:32-224  | tr:32-255  |
| GS64  | td:64-0  | td:64-32  |           | tr:64-96  | tr:64-128  | tr:64-160  | tr:64-192  | tr:64-224  | tr:64-255  |
| GS96  | td:96-0  | td:96-32  | td:96-64  |           | tr:96-128  | tr:96-160  | tr:96-192  | tr:96-224  | tr:96-255  |
| GS128 | td:128-0 | td:128-32 | td:128-64 | td:128-96 |            | tr:128-160 | tr:128-192 | tr:128-224 | tr:128-255 |
| GS160 | td:160-0 | td:160-32 | td:160-64 | td:160-96 | td:160-128 |            | tr:160-192 | tr:160-224 | tr:160-255 |
| GS192 | td:192-0 | td:192-32 | td:192-64 | td:192-96 | td:192-128 | td:192-160 |            | tr:192-224 | tr:192-255 |
| GS224 | td:224-0 | td:224-32 | td:224-64 | td:224-96 | td:224-128 | td:224-160 | td:224-192 |            | tr:224-255 |
| GS255 | td:255-0 | td:255-32 | td:255-64 | td:255-96 | td:255-128 | td:255-160 | td:255-192 | td:255-224 |            |

$t^*:x-y$ ...response time from level of gray(x) to level of gray(y)

$$\tau_{r1} = \Sigma(\text{tr}:x-y)/36, \tau_{d1} = \Sigma(\text{td}:x-y)/36$$

### 3-2. Response time (2)

The response time ( $\tau_{d2}$  and  $\tau_{r2}$ ) is the maximum value defined as the following figure and shall be measured by switching the input signal for “any level of gray (bright)” and “any level of gray (dark)”.



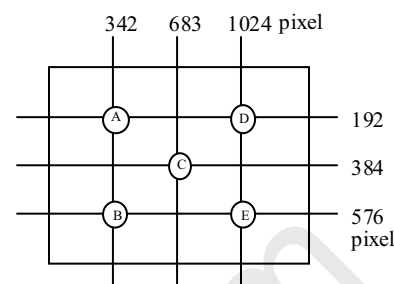
【Note 4】 This shall be measured at center of the screen.

【Note 5】 This value is valid when O/S driving is used at typical input time value .

【Note 6】 Definition of white uniformity ;

White uniformity is defined as the following with five measurements. (A~E)

$$\delta_w = \frac{\text{Maximum luminance of five points (brightness)}}{\text{Minimum luminance of five points (brightness)}}$$



## 10. Handling Precautions of the module

- Be sure to turn off the power supply when inserting or disconnecting the cable.
- This product is using the parts (inverter, CCFT etc), which generate the high voltage.

Therefore, during operating, please don't touch these parts.

- Brightness control voltage is switched for “ON” and “OFF”, as shown in Fig.4. Voltage difference generated by this switching,  $\Delta V_{INV}$ , may affect a sound output, etc. when the power supply is shared between the inverter and its surrounding circuit. So, separate the power supply of the inverter circuit with the one of its surrounding circuit.

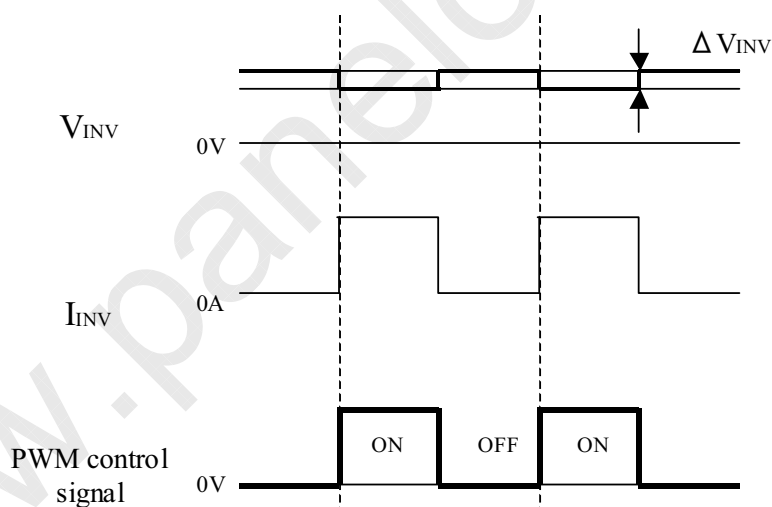


Fig.4 Brightness control voltage.

\*Since inverter board's GND is not connected to the frame of the LCD module, please connect it with the Customer's GND of inverter power supply.

- Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- Since the front polarizer is easily damaged, pay attention not to scratch it.
- Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
- When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.



LD- 17416-18

- i) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.
- j) The module has some printed circuit boards (PCBs) on the back side, take care to keep them from any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
- k) Observe all other precautionary requirements in handling components.
- l) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc.. So, please avoid such design.
- m) When giving a touch to the panel at power on supply, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.
- n) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.



## 12. Packing form

- a) Piling number of cartons: 3 maximum
- b) Packing quantity in one carton: 5 pcs.
- c) Carton size: 820 (W) × 420 (D) × 730 (H)
- d) Total mass of one carton filled with full modules: 50 kg(Max)

## 13. Reliability test item

| No. | Test item                                         | Condition                                                                                                                                                                                                                                                                                                   |
|-----|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | High temperature storage test                     | Ta=60℃ 240h                                                                                                                                                                                                                                                                                                 |
| 2   | Low temperature storage test                      | Ta=-25℃ 240h                                                                                                                                                                                                                                                                                                |
| 3   | High temperature and high humidity operation test | Ta=40℃ ; 95%RH 240h<br>(No condensation)                                                                                                                                                                                                                                                                    |
| 4   | High temperature operation test                   | Ta=50℃ 240h                                                                                                                                                                                                                                                                                                 |
| 5   | Low temperature operation test                    | Ta=0℃ 240h                                                                                                                                                                                                                                                                                                  |
| 6   | Vibration test<br>(non-operation)                 | Frequency: 10~57Hz/Vibration width (one side): 0.075mm<br>: 58~500Hz/Acceleration: 9.8 m/s <sup>2</sup><br>Sweep time: 11 minutes<br>Test period: 3 hours (1h for each direction of X, Y, Z)                                                                                                                |
| 7   | Shock test<br>(non-operation)                     | Maximum acceleration: 490m/s <sup>2</sup><br>Pulse width: 11ms, sinusoidal half wave<br>Direction: +/-X, +/-Y, +/-Z, once for each direction.                                                                                                                                                               |
| 8   | ESD                                               | * At the following conditions, it is a thing without incorrect operation and destruction.<br>(1)Non-operation: Contact electric discharge ±10kV<br>Non-contact electric discharge ±20kV<br>(2)Operation Contact electric discharge ±8kV<br>Non-contact electric discharge ±15kV<br>Conditions: 150pF、330ohm |

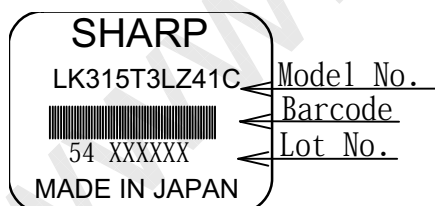
### 【Result evaluation criteria】

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

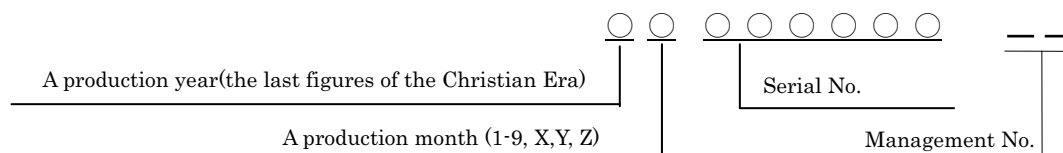
## 14. Others

### 1) Lot No. Label ;

The label that displays SHARP, product model (LK315T3LZ41C), a product number and “MADE IN JAPAN” is stuck on the back of the module.



### How to express Lot No.



## 2) Packing Label

|                                 |             |
|---------------------------------|-------------|
| 社内品番 : ( 4 S ) LK315T3LZ41C (①) |             |
| Bar code                        |             |
| Lot NO. : (1 T) 2005. *.** (②)  |             |
| Bar code                        |             |
| Quantity : (O)                  | 5 p c s (③) |
| Bar code                        |             |
| ユーザ品番 :                         |             |
| シャープ物流用ラベルです。                   |             |

① Management No. (LK315T3LZ41C)

② Lot No. (Date)

③ Quantity

- 3) Disassembling the module can cause permanent damage and should be strictly avoided.
- 4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
- 5) The chemical compound, which causes the destruction of ozone layer, is not being used.
- 6) Label of using material information

It is displaying the material of the optical parts with the label in the module back.

| MATERIAL INFORMATION     |
|--------------------------|
| LENS FILM :> PET,AK-X <  |
| DIFFUSER SHEET :> PET <  |
| DIFFUSER BOARD:> MMA/S < |
| REFLECTOR :> PET <       |

- 7) Cold cathode fluorescent lamp in LCD PANEL contains a small amount of mercury. Please follow local ordinances or regulations for disposal. This sentence is stamped on the backside of the module.

|                                                                                                                                                                                                                     |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                                                                                                                                  | HIGH VOLTAGE   |
|                                                                                                                                                                                                                     | <b>CAUTION</b> |
| RISK OF ELECTRIC SHOCK.<br>DISCONNECT THE ELECTRIC<br>POWER BEFORE SERVICING.                                                                                                                                       |                |
| *COLD CATHODE FLUORESCENT LAMP IN LCD PANEL<br>CONTAINS A SMALL AMOUNT OF MERCURY. PLEASE FOLLOW<br>LOCAL ORDINANCES OR REGULATIONS FOR DISPOSAL.<br>・当該液晶ディスプレイパネルは蛍光管が組込まれていますので、地方自<br>治体の条例、または、規則に従って廃棄してください。 |                |

- 8) When any question or issue occurs, it shall be solved by mutual discussion.

**15. Carton storage condition**

|                     |                                                                                                                                                                                                                                                        |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature         | 0℃ to 40℃                                                                                                                                                                                                                                              |
| Humidity            | 95%RH or less                                                                                                                                                                                                                                          |
| Reference condition | : 20℃ to 35℃ , 85%RH or less (summer)<br>: 5℃ to 15℃ , 85%RH or less (winter)<br>• the total storage time (40℃,95%RH) : 240H or less                                                                                                                   |
| Sunlight            | Be sure to shelter a product from the direct sunlight.                                                                                                                                                                                                 |
| Atmosphere          | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.                                                                                                                                              |
| Notes               | Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall<br>Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment |
| Storage life        | 1 year                                                                                                                                                                                                                                                 |

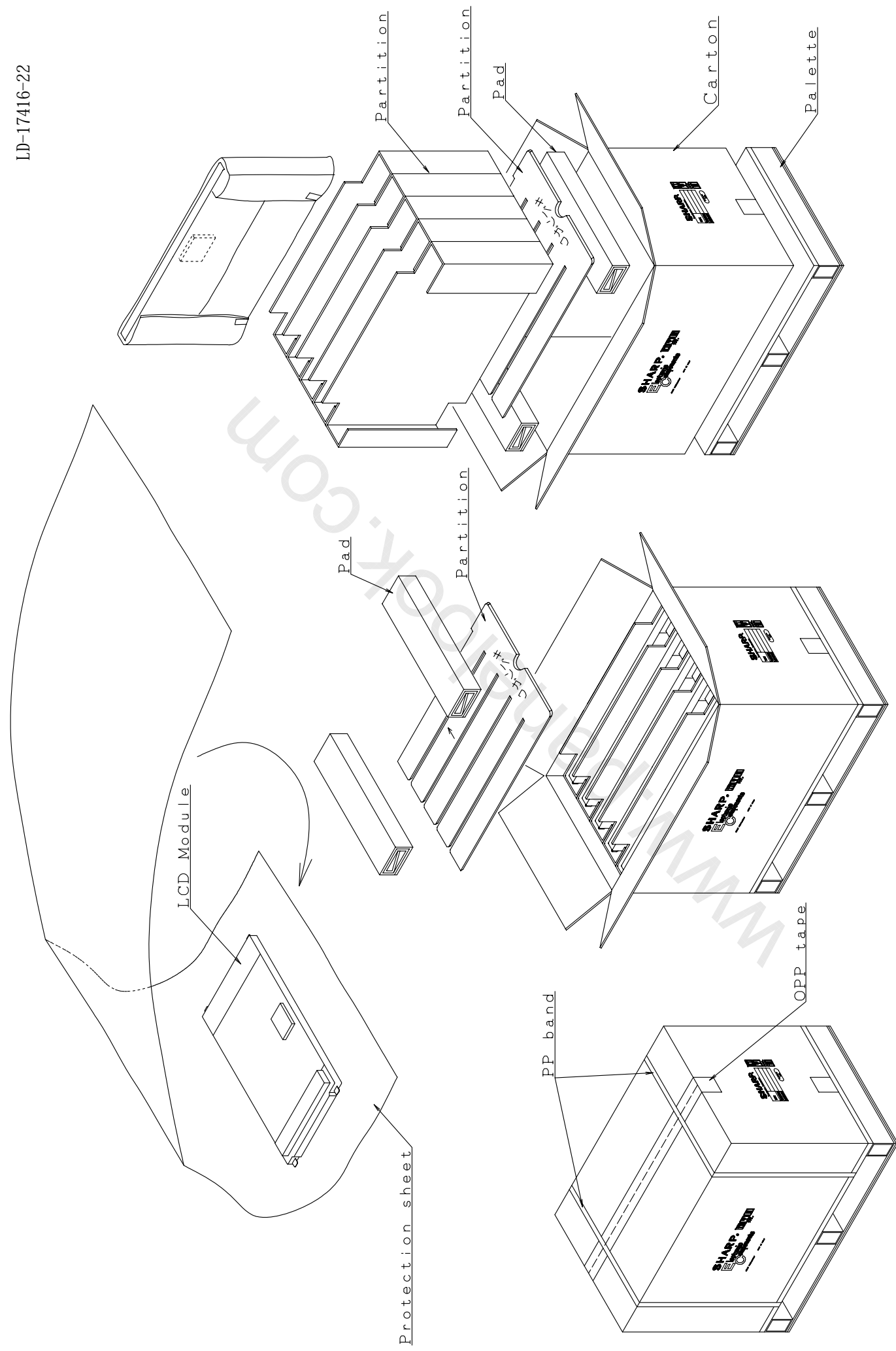
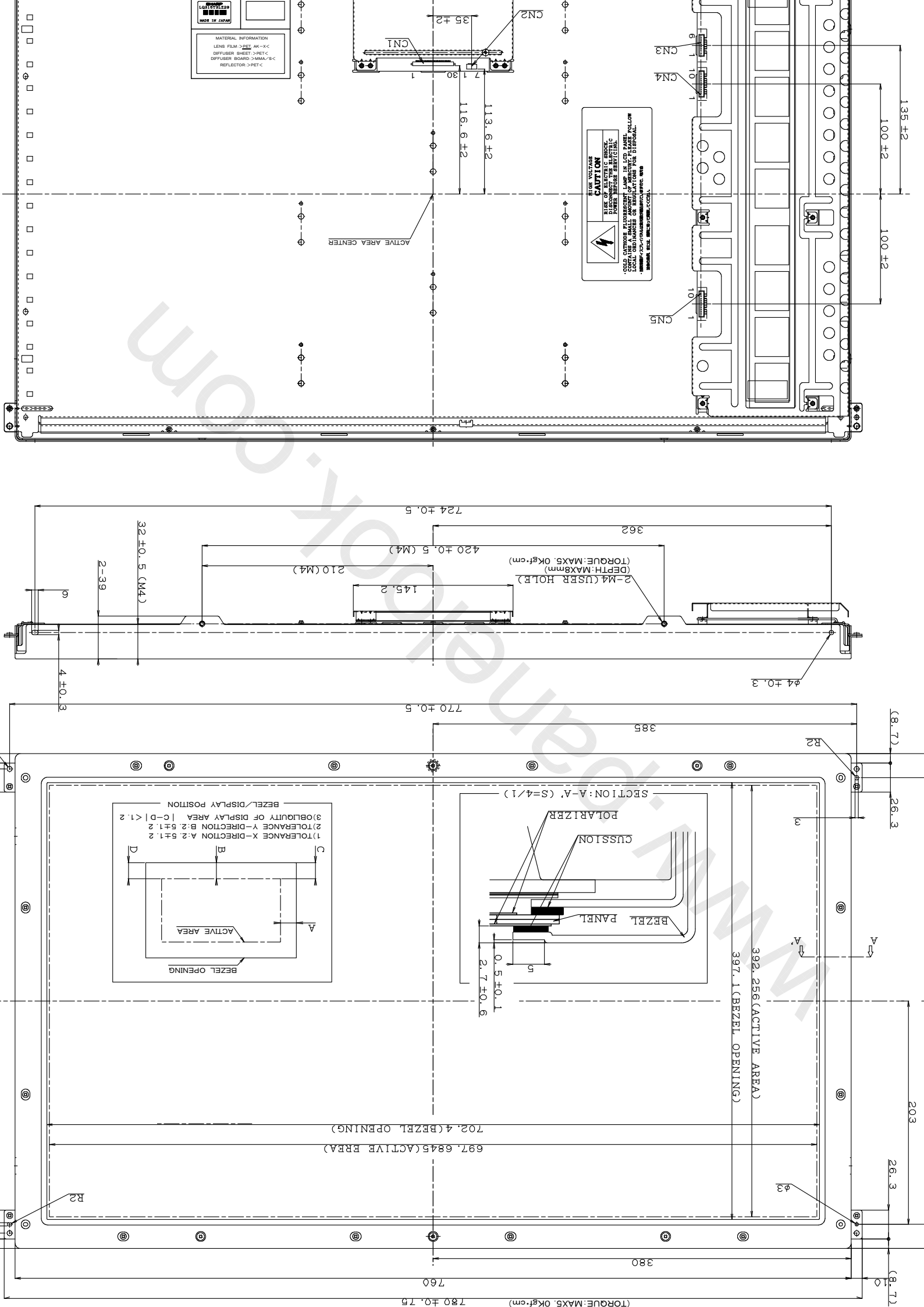


Fig 4 Packing form





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